

## CHAPTER 3: DEMAND, SUPPLY, AND MARKET EQUILIBRIUM

### Introduction

Supply and demand are mechanisms by which our market economy functions. Changes in supply and demand affect prices and quantities produced, which in turn affect profit, employment, wages, and government revenue. Chapter 3 introduces models explaining the behavior of consumers and producers in markets, as well as the effects of government policies on market activity. The concepts of supply and demand reappear throughout the economics course in discussions of wage determination, interest rates, currency values, and several other concepts. Material from Chapter 3 is heavily covered on the multiple-choice and free-response sections of both AP economics exams, but the macroeconomics questions are more likely to show up in the application of loanable funds, money, currency, or other aggregate markets.

### Markets

In market economies, the forces of supply and demand primarily determine the prices and quantities of products produced. Markets occur anywhere buyers and sellers engage in voluntary exchange, from restaurants to electronics stores to websites that sell music downloads. For the purposes of this chapter, we will focus on competitive markets with many buyers and sellers who do not have the market power to control prices or output. In later chapters, you will see how market power affects prices and the output of products.

### Demand

Demand is the consumer's willingness and ability to buy a product at a particular price. Both elements must be present because producers do not respond to wish lists; they produce for customers who are actually able to buy the product. Demand is determined first by developing a schedule indicating the quantity the consumer would buy at each potential price. The demand curve is then drawn by graphing those points.

### Taking the EEK! Out of Economics

If you have experience with graphs in math or science that place dependent variables on the vertical axis and independent variables on the horizontal axis, the graph setup for economics may look backwards to you. Economists generally develop market graphs with a monetary value on the vertical axis and the quantity of an item on the horizontal axis. This is simply the way economists have developed graphs, and it is important that you learn to follow these conventions to ensure you find the correct results in your analysis of supply and demand.

### The Law of Demand

The downward-sloping demand curve illustrates the inverse relationship between the price and quantity sold. According to the Law of Demand, at a lower price, consumers are willing and able to buy more; at a higher price, they buy less. This is something you learned long ago, but now we will explore the reasons for the relationship. It is important to understand that during this analysis, we are making the *ceteris paribus* assumption—that all other things are equal; nothing else is changing. If the consumer's income changed or the product was no longer desirable, changes in the quantity purchased could result from those changes, rather than from changes in the price of the product itself.

The demand curve slopes downward for three reasons:

- Diminishing marginal utility. The more of a good a person has, the less utility will be gained from each additional unit; therefore, firms must lower the price of the next unit to

entice customers to buy more. Shoe stores run a standard “buy one pair, get the next pair half off” sale for this reason.

- The income effect. When the price falls, consumers have more real income (purchasing power) available to buy more. If you planned to buy a pack of gum for \$1.00 and the store had a half-price sale, you could now buy two packs of gum because your dollar stretched further than before the sale.
- The substitution effect. When the price falls, customers buy more as a substitute for other products that now look relatively more expensive. If you had planned to buy a pack of gum and a candy bar for \$1.00 each and then noticed the half-price sale on gum, you might choose to spend the entire \$2.00 to buy four packs of gum because the gum is now so much less expensive than the candy bar.

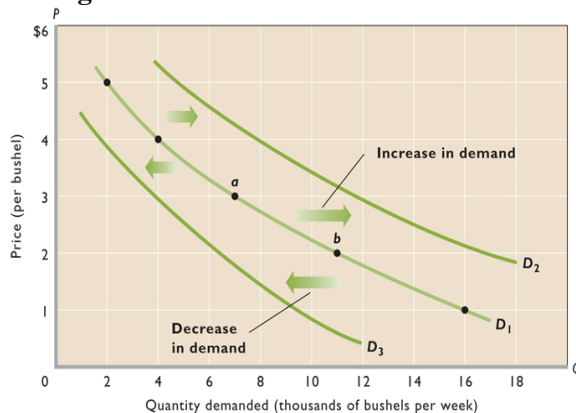
### Change in Quantity Demanded

The change in quantity demanded refers to a movement from one point to another point on the demand curve. The demand curve did not move. Only a change in the price of the product can cause a change in quantity demanded. Returning to the gum example, you only bought more gum because the price fell. It is very important to keep this definition in mind, because it can be very easily confused with a change in demand.

### Market Demand

While study of one consumer’s demand can help us understand the principles of demand, producers rarely consider the demand of a single customer. Instead, they focus on market demand—the demand of all customers together. To find the market demand, simply add the quantity demanded by all of the market’s individual consumers at each price. By determining the demand of millions of customers, the gum manufacturer can determine how many packs it would need to produce to satisfy market demand at each price.

### Change in Demand



### Changes in demand

A number of events can actually shift the demand curve. A change in demand results in consumers buying more (or less) of the product at every possible price. Increases in demand shift the curve to the right, while decreases in demand shift the curve to the left.

One factor that can change demand is a change in consumer taste. Consumer willingness to buy a product is often fueled by advertising, recommendations, or fads. As technology improved, consumer tastes in music changed from cassette tapes to CDs to MP3 files. A change in the

number of buyers also affects demand. As more immigrants entered the United States, stores responded to the increased demand by providing more ethnic foods.

Changes in consumer income affect the ability of consumers to buy products as well. But the effects of income depend on the type of product. Most goods are normal goods, for which demand increases when incomes rise and demand falls when incomes fall. Other products known as inferior goods have the reverse relationship to income. When incomes fall, consumers increase demand for inferior goods. If income falls, consumers buy more generic food rather than name-brand food. It is important to understand that consumers aren't actually buying more because their incomes fell; they are buying lower-priced substitutes for the products they would have purchased with a higher income.

#### **Taking the EEK! Out of Economics**

It is important to understand the difference between the income effect (which changes the quantity demanded) and a change in income (which shifts the demand curve). The income effect refers to the consumer's reaction to a change in price of the product. If you saw the price of gasoline significantly fall, you might put more in your tank because the \$20 you planned to spend for gasoline will now stretch further. Your demand curve for gas didn't move; you just moved from one point to another on your demand curve. However, an increase in your income would allow you to buy more gas at whatever price is being charged, because your demand curve for gas has shifted to the right. The key is to look at whether the price of the specific product changed (so your quantity demanded changed) or your income changed (so your demand for gas at all prices changed).

A change in the price of related products can also shift demand. Substitutes are products that can be used in place of each other. When the price of a good rises, consumers seek lower-priced substitutes. If you normally buy Mountain Dew and the store has a sale on Mello Yello, your demand for Mello Yello may increase. Complements are products that are used together. When the price of a product rises significantly, consumers will buy less of that product and the products that are used with it. When the price of gas rose, the demand for SUVs significantly fell because they just became too expensive to use.

#### **Taking the EEK! Out of Economics**

It is important to distinguish between the substitution effect (which changes the quantity demanded) and a change in the price of substitutes (which shifts the demand curve). The substitution effect focuses on the consumer's reaction to the change in price of a product. If you intended to buy chips and found the chips on sale for a lower price, you might buy more chips. Your demand curve for chips didn't shift; you simply responded to the lower price by buying more, which is a movement from one point to another point on your demand curve. However, if the price of a *different* product like pretzels fell, you might buy the pretzels instead of the chips, and your entire demand curve for chips would shift. The key is to look at whether the price of the specific product changed (so your quantity demanded changed) or the price of a different product changed, leading you to buy less of the original product as a result (so your demand for the product at all prices changed).

Consumer expectations also have important effects on the demand for products. If consumers expect the prices of products to increase soon, they will hurry out to buy those products before the price increase. On the other hand, if consumers are worried about the possibility of losing their

jobs in a recession, they are less likely to buy new homes and cars, and their demand falls for those products at every price.

### **Supply**

Supply is the quantity of goods producers are willing and able to produce. Just as with demand, a supply schedule is developed by determining how many products the producer will provide at each potential price.

### **The Law of Supply**

The upward-sloping supply curve illustrates the direct relationship between price and quantity sold. According to the Law of Supply, as the price rises, producers increase the quantity supplied; as the price falls, firms produce less. If a firm can make more money from product sales, the profit motive entices the firm to increase output. In addition, after some point, the cost of production begins to increase as the firm hires more workers or buys additional equipment; therefore, a higher price is necessary to cover those increased production costs. The firm can afford to produce more if the revenue it receives from selling the product is higher. In our analysis of supply, we again make the *ceteris paribus* assumption that nothing else in the world is changing except for the price of the product.

### **Taking the EEK! Out of Economics**

For supply, we are looking at the producer's decision of how many products to produce. It's very important *not* to think about supply as the quantity of products on a shelf. The products on the shelf represent previous output, not current production decisions, and looking at supply that way will cause errors in your analysis. If an increase in consumer demand causes the price of products to increase, that higher price serves as an incentive to produce more products, so the quantity supplied would increase. However, if you look at supply as "products on the shelf," you might see the higher demand resulting in consumers buying those products off the shelf, so you might conclude that the quantity supplied fell. Keep in mind that you're focusing on the producer's decision about production, and you'll be more likely to make the correct decisions in your analysis.

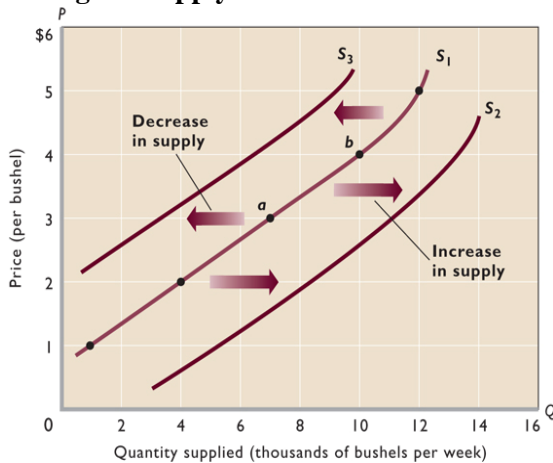
### **Market Supply**

Market supply is the sum of individual firms' supply curves in an industry. The market supply of cars includes the quantity supplied by all of the automakers at each price.

### **Change in Quantity Supplied**

A change in quantity supplied is a movement from one point to another point on the supply curve. When a producer is able to sell the product for a higher price, the quantity supplied by the firm increases; when the price of the product falls, the quantity supplied falls. The curve has not moved; the producer has only responded to a change in the price of the product. It is very important to remember that a change in quantity supplied only occurs when the producer sees a higher or lower price for the product and adjusts the firm's output as a result; nothing has caused the supply curve itself to move.

## Change in Supply



### Changes in supply

A change in supply is an actual shift of the supply curve. An increase in supply is shown by a shift of the curve directly to the right, as producers make more of the product at each potential price. A decrease in supply is shown by a shift directly to the left, as producers produce fewer products at each potential price.

### Taking the EEK! Out of Economics

It is very important to shift supply and demand curves to the left and right, not up and down. If you try to increase supply by shifting the curve straight up, you will actually create a new supply curve that lies to the left of the original supply curve—and as a result, your answers will all be reversed. Be sure to increase supply or demand by shifting the new curve to the right, and decrease supply or demand by shifting the new curve to the left, and you will be in the right position to continue your analysis.

One factor affecting supply is a change in the cost of resources firms need in order to produce their products. Higher labor, equipment, or utility costs lower profits, so firms produce less at each price; therefore, an increase in the cost of production reduces supply and shifts the curve to the left. On the other hand, if production costs fall, the firm earns additional profit and is willing to produce more at every price, so supply increases.

Changes in technology can also affect supply. When firms adopted the use of computers, automation, and other technologies, the firms were able to produce more products at a lower cost of production, so supply of those products increased.

Taxes and subsidies can also affect product supply. Because taxes are considered a cost of production for the company, higher taxes result in a lower supply of products, while lower taxes can increase product supply. A subsidy is a government payment to a firm to encourage some activity, such as expanding a factory in an urban area. Because the subsidy lowers the cost of production, the firm increases its supply of products.

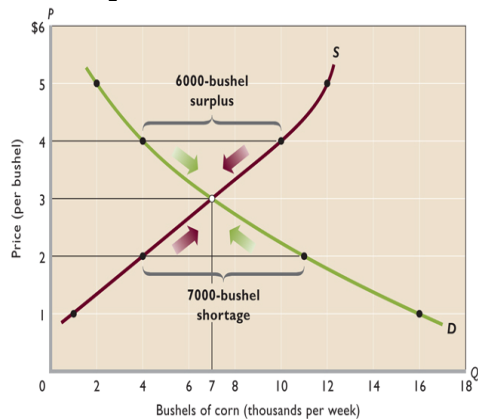
Changes in the prices of other products can also stimulate changes in supply. If firms discover they can make more profit by producing other products, they may choose to do so. When increased production of ethanol significantly increased demand for corn in commodity markets,

the price of corn soared. As a result, many farmers who had previously grown soybeans switched to produce corn, and the supply of soybeans fell.

Producer expectations about the future price of a product can also affect supply, though the producer's reaction may depend on the ability to quickly respond to that price change. If a rice farmer expects rice prices to significantly increase in the next month, there is no time to plant an additional crop; instead, the farmer may reduce the supply of rice for sale right now, waiting for the price to rise before selling it. However, if a carpet producer expects carpet prices to significantly increase in the next month, there is time to make more carpet, and the firm is likely to increase production to earn that higher revenue.

Another factor that changes supply is the number of firms in the industry. In general, the more producers in an industry, the greater supply of products at all prices; with fewer firms, fewer products are produced.

### Market Equilibrium



*Equilibrium prices and quantity*

When supply and demand are put together on a graph, the point of intersection is called equilibrium. At the equilibrium quantity, the quantity demanded by consumers equals the quantity supplied by producers. The equilibrium price is also called the market-clearing price, because at that price, all of the products produced will be bought by consumers; there are no leftovers or shortages. In this graph of the corn market, the equilibrium price is \$3 per bushel and the equilibrium quantity is 7,000 bushels of corn sold per week.

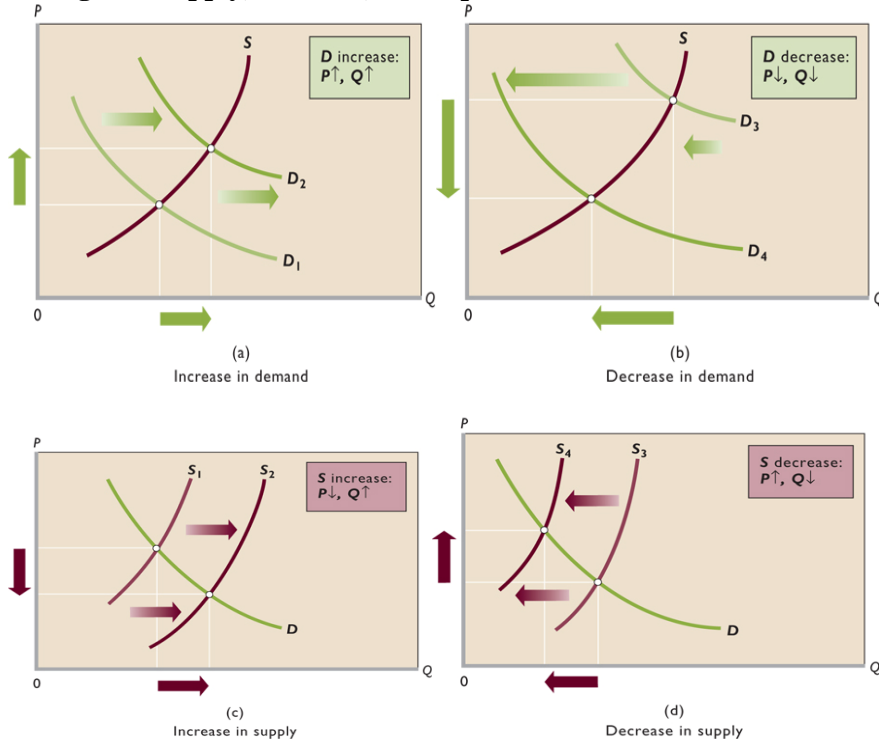
Markets seek equilibrium, and in the absence of government intervention or factors that shift either curve, the equilibrium will be found. If corn producers tried to sell corn for \$4 per bushel, producers would supply 10,000 bushels, but consumers would only demand 4,000 bushels, leaving a 6,000 bushel surplus. The quantity supplied is greater than the quantity demanded. How can we resolve the surplus? Reduce the price. At a price of \$3, the quantity demanded by consumers increases while the quantity supplied by producers falls until equilibrium is reached. If corn producers instead tried to set the price at \$2 per bushel, consumers would demand 11,000 bushels, but producers would only produce 4,000 bushels, resulting in a 7,000 bushel shortage—the quantity demanded is greater than the quantity supplied. How do we resolve the shortage? Raise the price. By raising the price to \$3, producers are willing to increase the quantity of corn supplied, while consumers reduce the quantity of corn they demand until equilibrium is again reached.

### The Efficiency of Markets

Open competition and incentives involved in supply and demand result in the efficient distribution of products and resources to produce them. Effective markets help to achieve two kinds of efficiency: productive and allocative efficiency. Productive efficiency is the production of a good in the lowest-cost way. Competition and consumer pressure for lower prices drive producers to find the lowest-cost methods of production. Productive efficiency is important because we know resources are scarce, and we want to allocate them in ways to produce more

products using fewer resources. Allocative efficiency is producing the combination of products that are most valuable to society. When society produces at the point where the marginal benefit to society (represented by demand) equals the marginal cost to society (represented by supply), society has achieved the proper mix of products.

### Changes in Supply, Demand, and Equilibrium



### Changes in demand and supply and the effects on price and quantity

#### Bear in Mind

The proper labeling of graphs is *essential* to earn full scores on the free-response portion of the AP economics exams.

- Label each axis (price on the vertical; quantity on the horizontal)
- Label each curve (supply and demand)
- Draw equilibrium lines and label equilibrium price and quantity (such as  $P$  and  $Q$ )
- Distinguish each curve that shows movement (such as  $D_1$  and  $D_2$ )
- Draw arrows between original and new curves to show the direction of movement
- Draw new equilibrium lines and label your new equilibrium price and quantity to distinguish them from the originals (such as  $P_1$  and  $P_2$ , and  $Q_1$  and  $Q_2$ )

Because scoring rubrics allocate points specifically for correctly labeled graphs, you can earn points just for getting that far—or easily lose points on an otherwise excellent response simply due to sloppy labeling. So maximize your potential score and label carefully!

Shifts in supply and demand curves cause changes in the equilibrium price and quantity of the product sold in the market. When demand increases, the new equilibrium is higher and to the

right of the original equilibrium; therefore, increases in demand result in a higher price and higher quantity. On a cold night at a high school football game, you would expect demand for coffee to rise—and entrepreneurs in the concession stand could raise the price and still sell more coffee due to the increased demand. A decrease in demand creates the opposite result, with the new equilibrium showing a lower price and quantity. When consumer demand for SUVs fell because of high gas prices, the quantity sold fell, and dealerships lowered prices in an attempt to draw buyers into the market.

### **Taking the EEK! Out of Economics**

Let the curves tell you what will happen to price and quantity. Students commonly make the mistake of worrying more about the firm’s revenue than the market analysis. For example, when demand falls, the quantity sold falls. Many students then make the mistake of thinking that the firm must then raise the price of the product to compensate for the lost sales and to “make up” for the lower revenues. But think about the situation: if consumers are already buying less, and then the firm raises the price, won’t consumers buy even less of the product? Keep drawing the graphs for each situation and let the curves illustrate what will happen to price and quantity, so you can avoid such mistakes.

If supply increases, the new equilibrium shows a lower price and a higher quantity sold. If farmers produce a large crop of tomatoes this year, the quantity increases, forcing the price per tomato down. If supply instead decreases, the equilibrium price rises, while the equilibrium quantity falls. When a hurricane damaged oil refineries, the supply of gasoline fell, reducing the quantity of gas in the market and causing the price to increase.

### **Taking the EEK! Out of Economics**

It is at this point that you can begin to understand why the distinction between a change in supply and a change in quantity supplied (or a change in demand and a change in quantity demanded) is so important. Let’s take the situation of an increase in demand. The demand curve shifts to the right, causing the price to increase. But did the *supply* increase? No. The *quantity supplied* increased as the producer responded to the higher price by moving to another point higher up the supply curve. Most multiple-choice and free-response questions on the AP economics exams involve the movement of only one curve at a time. Yet one of the most common mistakes students make is to confuse the situation and shift both curves (“Now that the price is higher, the firm will produce more, so I’ll shift the supply curve to the right...”). Keep in mind the factors that cause shifts in supply and demand, and determine which factor is at work—a demand factor or a supply factor. Then move only that curve and watch what happens. The other actor (the consumer or producer) will simply react to the change in price by adjusting the quantity bought/sold at that new equilibrium point; a second curve shift doesn’t happen!

### **Double Shifts**

In our examples to this point, we have assumed *ceteris paribus*—nothing else is changing during our analysis. Unfortunately, the models don’t always reflect real world conditions where many effects occur at the same time. Remember the smiley (☺)? Double shifts can be complicated, because while we can determine what will happen to either equilibrium price or quantity, we cannot know what will happen to the other. If we start at initial equilibrium, then increase demand and increase supply, then find the new equilibrium from the new supply and demand curves, we know for sure that quantity will increase, because both the increases in supply and demand cause increases in quantity. But we cannot know for sure whether the equilibrium price will rise or fall because that depends on how far the two curves shifted. If supply increased a lot



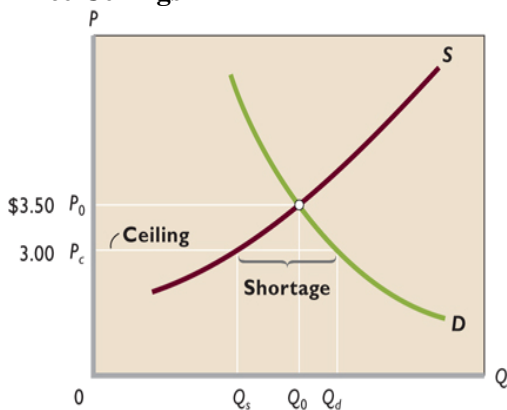
but demand only increased a little, the price would fall; if supply only increased a little but demand increased a lot, the price would rise. If both curves shifted by the same amount, the price would remain the same. If cell phone manufacturers developed new technology allowing them to produce at a lower cost at the same time that consumer incomes significantly fell, supply would increase while demand would fall. Because both curve shifts would result in a lower equilibrium price, we know for sure that the price of phones would fall. But because the higher supply increases the quantity and the lower demand reduces the quantity, the equilibrium quantity is indeterminate; we cannot know what will happen to the quantity.

### Bear in Mind

A couple of questions about double shifts have appeared fairly consistently on the multiple-choice portion of the AP microeconomics exam. Double shift questions clearly demonstrate that two separate events are occurring. For example, consumers are buying more iPods due to the new music trend, and workers in iPod-producing plants have gone on strike. The key is to look at each of the shifts independently and then find out what they have in common. An increase in demand causes price and quantity to go up. A decrease in supply causes price to go up and quantity to go down. Since both cause price to go up, we know equilibrium price will rise. Equilibrium quantity is indeterminate; we need more information to know whether it will rise, fall, or remain the same.

Sometimes the exam will pose a double shift question in reverse, with the stem of the question telling you that price and quantity both fell and the question asking which curve(s) must have moved which direction. The process of elimination may be your best tactic to deal with these questions. The key is to look very carefully at the wording of the question. If the question asks which curve shifts would *definitely* lead to a particular result that could be achieved by moving only one of the curves, and that option is one of the answers, that single curve movement is correct. If the question asks which curve shifts *could* lead to a particular result, start the process of elimination. If the result of both shifts is an increase in price, a combination of lower demand and higher supply could not create that result, so rule that answer out. Continue that process until you have only one answer left.

### Price Ceilings

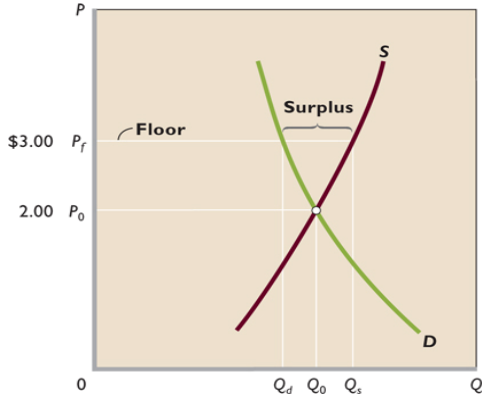


#### A price ceiling

Sometimes government officials identify goals that are more important than efficiency and create policies to intervene in markets. When a government sets a price ceiling below the equilibrium price, it sets a maximum price firms can charge, helping consumers by lowering the price. In this example, the equilibrium price is \$3.50, but the government has set the price ceiling at \$3.00. At

the \$3.00 price, the quantity demanded is greater than the quantity supplied, so a shortage develops. Because the market cannot efficiently allocate the good, how do we determine who gets the fewer available products? Black markets often develop in such situations, as the market struggles to find equilibrium.

### Price Floors



#### A price floor

A price floor is a minimum price set by a government. An effective price floor, set above the equilibrium price, is intended to help producers by keeping prices higher. In this example, the equilibrium price is \$2.00, but the price floor of \$3.00 causes firms to increase production while consumers buy less at the higher price, resulting in a surplus. As a consequence, the government must either buy or find other uses for the surplus, and resources that are used to produce this excess cannot be used to produce the other products consumers do want. Because market distortions are caused by price ceilings and floors, American government officials generally allow markets to allocate goods and services.

#### Taking the EEK! Out of Economics

The placement of the price floor or ceiling in relation to equilibrium may be confusing until you think about what they really mean. A price ceiling *below* equilibrium? Isn't a ceiling high? Think about the market, which always seeks equilibrium. If government imposes a price ceiling below equilibrium, market pressure tries to push prices upward—toward that equilibrium—but the price cannot legally rise. Therefore, it is an effective price ceiling. Now consider what would happen if the equilibrium price of the product were \$7, and the government established a price ceiling of \$8 on the product. What would happen? Absolutely nothing. A price ceiling higher than equilibrium has no effect because the market rests at equilibrium until something disturbs it. Conversely, if the government places a price floor above equilibrium, market pressure tries to pull the price down to equilibrium, but it cannot go lower because of the floor. If you think about price ceilings and floors as barriers to letting the market go to equilibrium, where it naturally wants to go, it can help you remember where a price floor or ceiling belongs in the graph.

### Multiple-Choice Questions

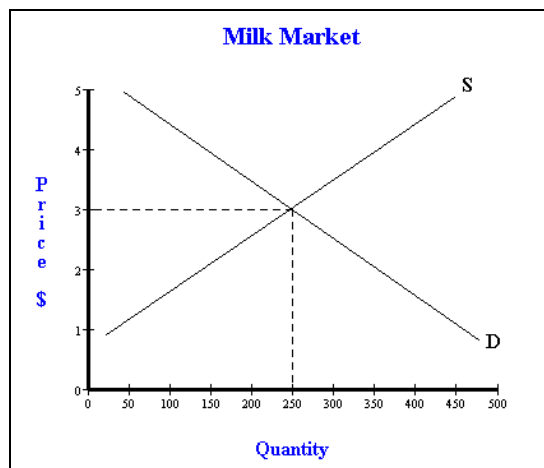
- Which situation is the best example of the Law of Demand?
  - When the price of books increases, consumers buy fewer books.
  - When wages of auto workers rise, automakers raise the price of cars.
  - When the price of computers falls, demand for computer games increases.
  - When the productivity of bricklayers rises, demand for bricklayers falls.
  - When consumer incomes rise, consumers buy more televisions.
- Each of the following could result in an increased demand for bicycles EXCEPT
  - The price of gasoline increases significantly.
  - The price of bicycle helmets increases significantly.
  - The local government develops several bicycle trails in the area.
  - Consumer incomes increase.
  - The number of children in the community increases.
- If demand for Product X decreases when the price of Product Y decreases, then
  - Products X and Y are not related.
  - Products X and Y are both inferior goods.
  - Products X and Y are complements.
  - Products X and Y are substitutes.
  - Product X is a normal good, while Product Y is an inferior good.
- Steak is a normal good and bologna is an inferior good. If consumer incomes fall,
  - the prices for steak and bologna both will increase.
  - the prices for steak and bologna both will decrease.
  - the price for steak will increase and the price for bologna will decrease.
  - the price for steak will decrease and the price for bologna will increase.
  - the prices for steak and bologna will both remain unchanged.
- Which of these situations would cause an increase in the supply of jeans?
  - The cost of cotton used to produce jeans increases.
  - The number of firms producing jeans decreases.
  - Producers improve productivity with computerized sewing machines.
  - Consumers increase their demand for jeans.
  - The government imposes a per-unit tax on the production of jeans.
- A short-run increase in the cost of production will cause
  - the supply curve to shift to the left.
  - the supply curve to shift to the right, while demand will shift to the left.
  - the demand curve to shift to the left, while supply will shift to the right.
  - both the supply and demand curves to shift to the left.
  - the demand curve to shift to the left.
- What would cause the price of jellybeans to rise in the market?
  - Consumers reduce their demand for jellybeans, so firms must raise their prices to compensate for the lost product sales.
  - The cost of the sugar required to make jellybeans falls.
  - The incomes of jellybean consumers fall.
  - Consumers change their preference to buy healthier foods, so their demand for jellybeans falls.
  - The government imposes a per-unit tax on the sale of jellybeans.

8. When ducks are slaughtered for meat, their feathers can be used in the production of pillows. Given this relationship, if the demand for duck meat rises,
- (A) the price of feather pillows falls.
  - (B) the supply of feather pillows falls.
  - (C) the demand for feather pillows rises.
  - (D) the price of duck meat falls.
  - (E) the supply of duck meat rises.
9. Which of the following curve shifts would definitely cause both the equilibrium price and equilibrium quantity to increase?
- |     | <i>Supply</i> | <i>Demand</i> |
|-----|---------------|---------------|
| (A) | Increase      | Decrease      |
| (B) | Decrease      | Decrease      |
| (C) | No change     | Decrease      |
| (D) | Increase      | No change     |
| (E) | No change     | Increase      |
10. In a competitive shoe market, if consumer incomes rise at the same time that the cost of production rises for shoes, one *definite* result would be
- (A) an increase in the quantity of shoes sold.
  - (B) an increase in the price of shoes.
  - (C) an increase in the profits of shoemakers.
  - (D) a decrease in the demand for slippers (a substitute for shoes).
  - (E) a decrease in the supply of slippers (a substitute for shoes).
11. The purpose of a price ceiling is to
- (A) help producers by setting a minimum legal price for a product.
  - (B) raise revenue for the federal government.
  - (C) create a surplus of the product to be saved for future use.
  - (D) help consumers by lowering the legal price of the product.
  - (E) ensure enough of the product is produced to fully meet demand.
12. An effective price floor for rice will cause
- (A) a decrease in the quantity of rice supplied.
  - (B) a long-run shortage of rice.
  - (C) a decrease in the quantity of rice demanded.
  - (D) the supply curve for rice to shift to the right.
  - (E) The price of rice to fall.

### Free-Response Questions

1. Farmers sell sweet corn and green beans, which are substitute products, from roadside stands in competitive markets. Suppose the surgeon general announces results of a study indicating the consumption of corn causes diabetes in humans.
- (a) Using a correctly labeled supply and demand graph for sweet corn, show the effect of the announcement on each of the following in the short run.
- (i) Price
  - (ii) Output
  - (iii) Explain the reason for this effect.

- (b) Using a separate, correctly labeled supply and demand graph for green beans, show the effect of the announcement on each of the following in the short run.
- Price
  - Output
  - Explain the reason for this effect.
- (c) Now assume that butter, a complement of sweet corn, is sold in a competitive market. In a third, correctly labeled supply and demand graph for butter, show the effect of the announcement on each the following in the short run.
- Price
  - Output
  - Explain the reason for this effect.
2. Assume that milk is sold in a competitive market, which is currently at equilibrium where the store sells 250 gallons of milk per week at a price of \$3 per gallon.



- Redraw the graph above and show how an increase in the cost of cattle feed will affect the equilibrium price and quantity of milk. Explain.
- Now assume the government has imposed an effective price ceiling in the milk market. Redraw the graph above and indicate each of the following.
  - The correct position of an effective price ceiling
  - The new quantity demanded as a result of the price ceiling
  - The new quantity supplied as a result of the price ceiling
- What economic problem will result from the price ceiling?

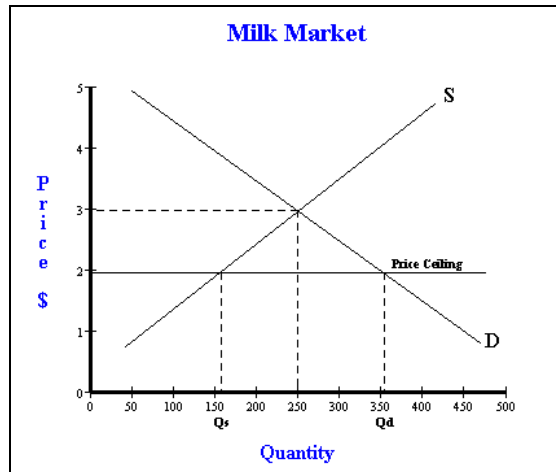
### Multiple-Choice Explanations

- (A) The Law of Demand says that at lower prices, people buy more and at higher prices, people buy less. B involves lower supply; C discusses complements; D incorrectly discusses a relationship in the labor market; E involves a change in demand rather than a change in quantity demanded.
- (B) Bicycles and helmets are complements; if the price of helmets increases significantly, demand for bicycles would be expected to fall.
- (D) When the price of substitute Product Y falls, consumers reduce demand for Product X and increase the quantity of Product Y they demand instead.
- (D) When incomes fall, demand for normal goods falls, while demand for inferior goods rises, and prices move with the changes in demand.

5. (C) Higher productivity allows firms to produce more at every price. Beware of answers like D; increased demand causes a change in *quantity* supplied (a move along the supply curve) but not a shift in the supply curve.
6. (A) A change in the cost of production is one of the factors that can shift the supply curve; it does not cause any change in the demand curve.
7. (E) Per-unit taxes raise production costs, lowering supply. Beware of answers like A; if demand falls, firms must lower their prices, not raise them.
8. (A) Because duck meat and feathers are harvested together, the increase in the quantity of duck meat supplied will result in a greater supply of feathers, reducing the cost of pillow production; the increase in feather pillow supply lowers the price of feather pillows.
9. (E) An increase in demand definitely causes both price and quantity to increase. A is eliminated because both cause price to fall; B is eliminated because both cause quantity to fall. C and D cannot create the result.
10. (B) Because the increase in demand (caused by higher incomes) and the decrease in supply (caused by higher costs of production) both result in higher prices, the combination will definitely cause the price to increase.
11. (D) A maximum legal price below equilibrium may help some consumers by lowering prices, but the price ceiling results in a shortage.
12. (C) A price floor raises the price of rice, and as a result, consumers are not as willing or able to buy as much rice.

### Free-Response Explanations

1. **12 points** (4 + 4 + 4)
  - (a) 4 points:
    - 1 point is earned for a correctly labeled graph with equilibrium price and quantity.
    - 1 point is earned for showing a leftward shift of the demand curve.
    - 1 point is earned for showing that equilibrium price and quantity decrease.
    - 1 point is earned for explaining that consumer tastes changed to no longer desire corn.
  - (b) 4 points:
    - 1 point is earned for a correctly labeled graph with equilibrium price and quantity.
    - 1 point is earned for showing a rightward shift of the demand curve.
    - 1 point is earned for showing that equilibrium price and quantity increase.
    - 1 point is earned for explaining that because demand for corn fell, demand for the corn substitute would increase.
  - (c) 4 points:
    - 1 point is earned for a correctly labeled graph with equilibrium price and quantity.
    - 1 point is earned for showing a leftward shift of the demand curve.
    - 1 point is earned for showing that equilibrium price and quantity decrease.
    - 1 point is earned for explaining that because corn and butter are complements, a decrease in demand for corn also results in a decrease in demand for butter.
2. **7 points** (3 + 3 + 1)
  - (a) 3 points:
    - 1 point is earned for showing a leftward shift of the supply curve.
    - 1 point is earned for showing that price increases and quantity decreases.
    - 1 point is earned for explaining that the higher cost of milk production reduces the supply of milk, because some dairy farmers will reduce production or entirely leave the industry.



- (b) 3 points:
- 1 point is earned for showing a price ceiling at a price lower than the equilibrium price of \$3.
  - 1 point is earned for showing a higher quantity demanded at the price ceiling.
  - 1 point is earned for showing a lower quantity supplied at the price ceiling.
- (c) 1 point:
- 1 point is earned for stating that a shortage is the economic problem.